

WHAT IS CLAIMED IS:

1. A zoom lens comprising, in order from an object side to an image side:

a first lens unit of a negative optical power;

5 a second lens unit of a positive optical power;

and

a third lens unit of a positive optical power, said third lens unit having a cemented lens formed by cementing a positive lens element to a negative lens
10 element and moving along an optical axis for zooming,

wherein a space between said first and second lens units decreases, and a space between said second lens unit and said third lens unit increases in zooming from a wide angle end to a telephoto end, and

15 letting NL_i be the number of lens elements constituting an i th lens unit, a condition defined by

$$NL_3 < NL_2 \leq NL_1$$

is satisfied.

20 2. A zoom lens according to claim 1, wherein

said first lens unit has, in order from the object side to the image side, a negative lens element in a meniscus shape with a concave surface facing the image side and a positive lens element in a meniscus shape
25 with a convex surface facing the object side, and has not less than three lens elements, and

said second lens unit consists of, in order from

the object side to the image side, a cemented lens formed by cementing a positive lens element to a negative lens element and a positive lens element in a biconvex shape.

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3. A zoom lens according to claim 2, wherein letting d be a thickness of the cemented lens of said second lens unit on the optical axis, and f_w be a focal length of an overall system at a wide angle end, a conditional expression,

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$$0.3 < d/f_w < 0.5$$

is satisfied.

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4. A zoom lens according to claim 1, wherein said first lens unit has, in order from the object side to the image side, a negative lens element in a meniscus shape with a concave surface facing the image side and a positive lens element in a meniscus shape with a convex surface facing the object side, and

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said second lens unit consists of, in order from the object side to the image side, a cemented lens formed by cementing a positive lens element to a negative lens element and a positive lens element in a biconvex shape.

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5. A zoom lens according to claim 4, wherein letting d be a thickness of the cemented lens of said

second lens unit on the optical axis, and fw be a focal length of an overall system at a wide angle end, a conditional expression,

$$0.3 < d/fw < 0.5$$

5 is satisfied.

6. A zoom lens according to claim 1, wherein said second lens unit has, in order from the object side to the image side, a cemented lens formed by cementing a positive lens element to a negative lens element and a positive lens element with biconvex surfaces, and

10 letting Ra be a radius of curvature of a lens surface of the cemented lens of said second lens unit which is located nearest to the object side, Rb be a radius of curvature of a lens surface of the cemented lens of said second lens unit which is nearest to an image side, Rc be a radius of curvature of a lens surface of said biconvex positive lens element which is located on the object side, and Rd be a radius of curvature of a lens surface of said biconvex positive lens element which is located on the image side, conditional expressions,

$$0.7 < Rb/Ra < 1.2$$

25 $-0.6 < (Rd + Rc)/(Rd - Rc) < 0.6$ are satisfied.

7. A zoom lens according to claim 6, wherein
letting d be a thickness of the cemented lens of said
second lens unit on the optical axis, and fw be a focal
length of an overall system at a wide angle end, a
5 conditional expression,

$$0.3 < d/fw < 0.5$$

is satisfied.

8. A zoom lens according to claim 1, wherein a
10 lens surface of said second lens unit which is located
nearest to the object side has a convex shape on the
object side and has aspherical shape which is designed
to weaken a converging effect from the optical axis to
a periphery.

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9. A zoom lens according to claim 1, wherein said
third lens unit moves along a convex locus to the image
side in zooming from the wide angle end to the
telephoto end.

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10. A zoom lens according to claim 1, wherein
said second and third lens units move along the
optical axis for zooming, and

25 said second lens unit has a cemented lens formed
by cementing a positive lens element to a negative lens
element.

11. A zoom lens according to claim 1, wherein letting f_{3n} be a focal length of the negative lens element of the cemented lens of said third lens unit, f_3 be a focal length of said third lens unit, v_{3n} be an Abbe number of the negative lens element of the cemented lens of said third lens unit, and N_{3n} be a refractive index, conditional expressions,

$$0.8 < f_{3n}/f_3 < 1.7$$

$$v_{3n} < 40$$

10 $1.7 < N_{3n}$

are satisfied.

12. A zoom lens according to claim 1, wherein said first lens unit has, in order from the object side to the image side, a positive lens element with a convex surface facing the object side, a negative lens element in a meniscus shape with a concave surface facing an image side, a negative lens element, and a positive lens element in a meniscus shape with a convex surface facing the object side.

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13. A zoom lens according to claim 1, wherein letting M_1 be a zoom position where said third lens unit is located nearest to the image side in an entire zooming range, x_{3w} be a moving distance of said third lens unit in zooming from the wide angle end to the zoom position M_1 , and x_{3t} be a moving distance of said

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third lens unit in zooming from the zoom position M1 to the telephoto end, a conditional expression,

$$0.2 < x_{3w}/x_{3t} < 3.0$$

is satisfied.

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14. A zoom lens according to claim 1, wherein letting β_{3t} be a lateral magnification of said third lens unit at the telephoto end, a conditional expression,

10 $0.6 < \beta_{3t} < 0.8$

is satisfied.

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15. A zoom lens according to claim 1, wherein said third lens unit moves along the optical axis for focusing.

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16. A zoom lens according to claim 1, wherein said second lens unit has, in order from the object side to the image side a cemented lens formed by cementing a positive lens element to a negative lens element and a positive lens element in a biconvex shape surfaces, and

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letting R_a be a radius of curvature of a lens surface of the cemented lens of said second lens unit which is located nearest to the object side, R_b be a radius of curvature of a lens surface of the cemented lens of said second lens unit which is located nearest

to an image side, R_c be a radius of curvature of a lens surface of said positive lens element in a biconvex shape which is located on the object side, R_d be a radius of curvature of a lens surface of said positive lens element in the biconvex shape which is located on the image side, d be a thickness of the cemented lens of said second lens unit on the optical axis, f_w be a focal length of an overall system at a wide angle end, f_{3n} be a focal length of the negative lens element of the cemented lens of said third lens unit, f_3 be a focal length of said third lens unit, v_{3n} be an Abbe number of the negative lens element of the cemented lens of said third lens unit, and N_{3n} be a refractive index, conditional expressions,

15 $0.7 < R_b/R_a < 1.2$
 $-0.6 < (R_d + R_c)/(R_d - R_c) < 0.6$
 $0.3 < d/f_w < 0.5$
 $0.8 < f_{3n}/f_3 < 1.7$
 $v_{3n} < 40$
20 $1.7 < N_{3n}$
are satisfied.

17. A zoom lens according to claim 16, wherein letting M_1 be a zoom position where said third lens unit is located nearest to the image side in an entire zooming range, x_{3w} be a moving distance of said third lens unit in zooming from the wide angle end to the

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zoom position M1, x_{3t} be a moving distance of said third lens unit in zooming from the zoom position M1 to the telephoto end, and β_{3t} be a lateral magnification of said third lens unit at the telephoto end,

5 conditional expressions,

$$0.2 < x_{3w}/x_{3t} < 3.0$$

$$0.6 < \beta_{3t} < 0.8$$

are satisfied.

10 18. A zoom lens according to claim 1, wherein said zoom lens forms an image on a photoelectric conversion element.

15 19. An image taking apparatus comprising an image taking lens for forming an image of an object on a photosensitive surface, said image taking lens comprising said zoom lens defined in claim 1.

20 20. An image taking apparatus comprising:
a photoelectric conversion element; and
an image taking lens for forming an image of an object on a photosensitive surface, said image taking lens comprising said zoom lens defined in claim 1.